An Operational perspective on ATM requirements

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Objectives of presentation

- Provide an operational perspective, independently from technology, of the requirements for information from the aircraft;
- Present some operational services on operations and under development and related issues.
- Present Cooperative ATS;

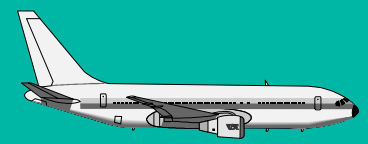
ODIAC: The AGC Operational Group

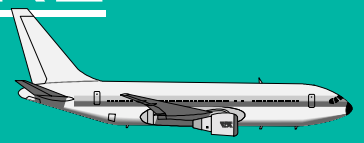
- Active participation of 11 States and aviation community (IATA, IFALPA, IFATCA, Industry..)
- Develop concepts and operational requirements for integrated a/g data communications and surveillance services
- Users, human factors, and benefits driven
- Contributes to worldwide standardisation via consolidated European reqs at ICAO OPLINK Panel

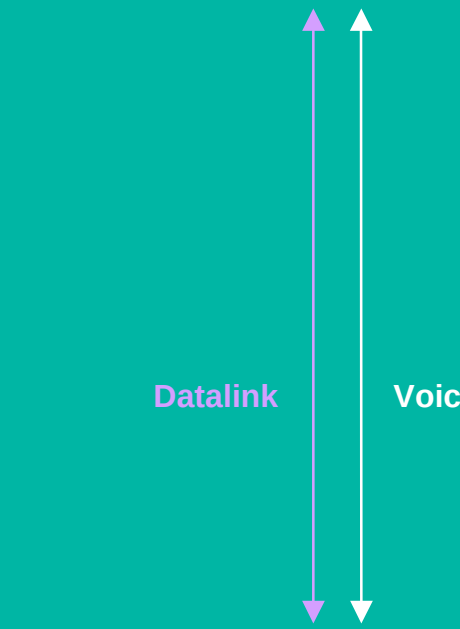
Benefits driven and Human Centred Automation

- User developed requirements, specific methodology (Template) to define requirements;
- Airlines and ATM needs (cost, safety, productivity);
- Procedures, human factors and safety are inherent parts of the requirements;
- End to end performance and system support; Prototyping, Simulation and TRIALS along with requirements definitions;
- Evolution not revolution;
- Not technology dependent, it is assumed that an appropriate infrastructure (e.g. the ATN) will be available and seamless for users.

AGC CURRENT AND FUTURE ACTIVITIES







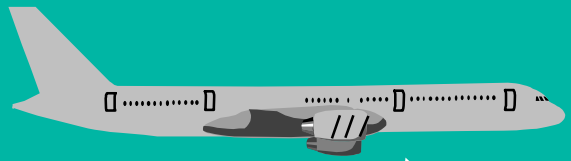
Progress toward Cooperative ATS, "the Pilot in the ATC loop"

- **Operational concept: first draft done;**
- **Operational requirements;**
- **Validation;**
- **Surveillance concept and requirements, Enhanced surveillance, RSP, (SCORS Task force);**
- **Airborne Traffic Situational Awareness, Cooperative separation and Autonomous Flight operations.**
- **Continued input to ICAO (e.g. RCP/RSP).**

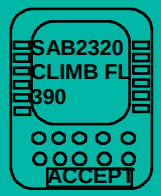
What is an operational requirement ?

- A statement of the operational attributes of a system needed for the effective and/or efficient provision of Air Traffic Services to users;
- Why ?: respond to the air traffic demand; reduce constraints, maintain or increase safety, get benefits...
- Who ?: operational experts, in this case Pilots and Controllers assisted by Engineers and Industry.

OPERATIONAL CONCEPT FOR THE USE OF AIR/GROUND DATA AND VOICE COMMUNICATIONS IN EN-ROUTE CENTRES IN EUROPE



Pilot Interface



Downstream Clearances

FLIPCY
DYNAV

Pilot preferences

Data

Downlink of Airborne Parameters:

***Instant Paras*:**

Indicated Heading, vertical rates, Indicated airspeed

Wind vector

AutoPilot settings:

Flight Level.

Extended surveillance

Intent: FPL

Data link Flight Information Services

CPDLC DIALOGUES

Frequency change

Strategic and routine Clearances

Acknowledgements

Tactical clearances for real time separations and non standard messages

Voice primary

SAB2320
PROCEED TO
DVR
Execute

Data

TWR

DEPARTURE CLEARANCE

Coms Service

Controller interface

ACC/UAC

Services provided by a controller based on surveillance systems

- Prevent collisions between aircraft;
- Prevent aircraft from flying into uncontrolled, uncoordinated, restricted or danger areas;
- Reduce lateral and horizontal separations to increase traffic flow (10, 5 and 3 NM);
- Provide essential traffic information (unknown traffic, conflicting traffic not in contact, priority traffic);
- Assist aircraft in difficulty or emergency (weather, radio failure, hijacking or distress);

What information is needed to provide surveillance services?

- Critical: Position, call sign and altitude. Enables 5 and 3NM separations;
- Essential: Airspeed, Heading, short term intent, and other parameters. Enables high increase in efficiency for tactical controllers and improve some ground tools.
- Beneficial: Full 4D flight path Intent (FMS). Enables to improve trajectory prediction, thus ATM functions such as conflict detection, conformance monitoring, etc.

How to classify ?

- Elementary (critical);
- Enhanced (Essential)
- Intent based (Beneficial)

Wherever the information comes from, the items needed should form a Required Surveillance Performance set of parameters, independent from technology, thus if ADS meets the criteria it is operationally acceptable.

Why Downlink Airborne Parameters ?

- A generic term independent from technology (ADS can support DAPs);
- DAPs can Provide Information from the Aircraft to: ATCO, Ground systems and Aircrew of other aircraft;
- To ATCO and Aircrew: Call sign, Air vector, Intent (short or extended) SAME FOR BOTH!;
- To ground systems and ATCO: Position, Flight path intent and others to improve ground tools.

Auto Downlink of Airborne Parameters (ADAP)

- **<u>Controller Access Parameters (Enhanced Surveillance)</u>**
  Mainly for increasing controller productivity
- **Instantaneous parameters (Air vector)**
  Indicated air Speed, heading, vertical rate, wind vector, turbulence.
- **Selected Altitude (Pilot settings)**
  the only one operationnally acceptable by pilots and a major safety issue (level busts rise).
- **Implementation: Mode S or ADS air vector.**

The ADS: A bit of history

- ADS was designed to provide automated position reports in non radar areas to decrease procedural horizontal separations.
- ADS B original ideas were about providing an affordable TCAS for general aviation.
- Both have evolved into more ATM related functions and possibilities.
- ADS is used in the South Pacific, Japan, China, India, etc. (AEEC 745 standard) and in PETAL II in Europe.
- There seems to be confusion of potential usage of the various ADS functions

Operational use of ADS in PETAL II, on line over FANS

Service		NEAN	FANS	ATN 2000
FLIPCY	**DAP of route points, A/C type and ADES for comparison**	**ADS Demand Contract**	**ADS Demand Contract**	**ADS Demand Contract**
Enhanced SUR	**DAP of IHDG, IAS/MACH, ROVC, W/V. for controller display**	**N/A**	**ADS Periodic Contract**	**ADS Periodic Contract**
Broadcast DAP	**Pilot input of RFL, MFL, TOD for controller info**	**ADS-B**	**N/A**	**N/A**

ADS B, the ultimate solution ?

- **ADS B is an enabling technology which has great potential for many types of applications; Difficulty to choose among the many in a world scene.**

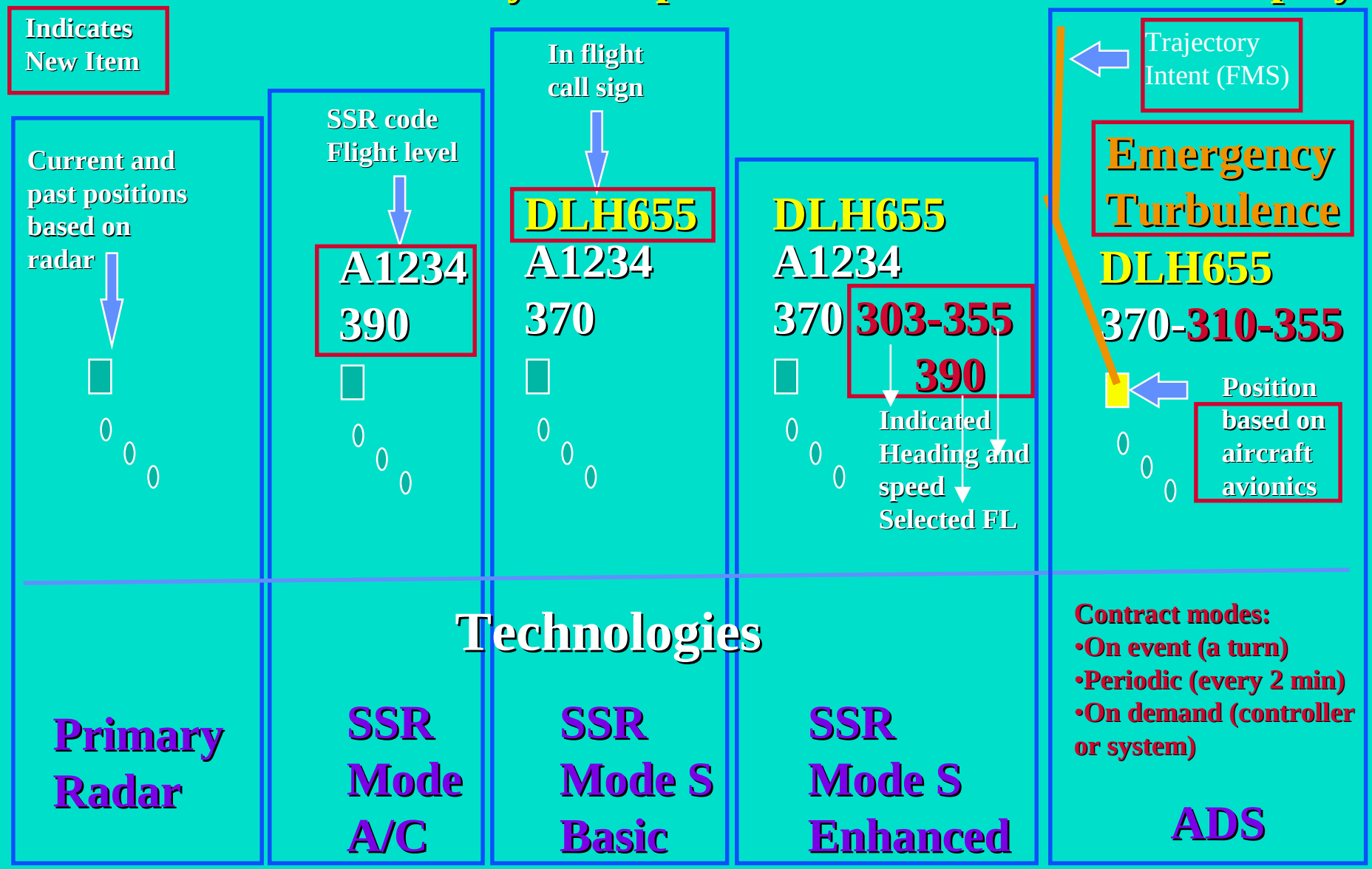
Operationally 3 sets can be envisaged:

- **Supplement and/or replace radar surveillance;**
- **Provide enhanced and Intent based surveillance;**
- **Provide additional information to aircrew for improved traffic situational awareness.**

Intent based ATM

- Use of the flight path intent data (via e.g. ADS extended projected profile or ARINC FPI bus) for:
- Trajectory prediction, Conflict detection, conformance monitoring, ATFM, CDM, AOC, automation tools, Airborne Traffic Situational Awareness information, etc.
- Can be automated, manual, on event or periodic, to be defined;

What can surveillance systems present to a controller on a display



Common Trajectory Coordination: COTRAC

- Trajectory coordination (4D) between Aircrew and Controller through the use of a structured negociation method, using data communications as enabler, in order to establish a trajectory contract. Strong request from users, PHARE demo.
- Optimum use through graphical interfaces;
- Time UTC, Level, Lat/Lon and attibute (Proposed, accepted, rejected, stand-by etc.)
- High potential, radical reduction in com needs
- Trajectory prediction, conflict detection and conformance monitoring greatly enhanced;

FLIPCY, Flight Plan Consistency

- This service permits the ground system to check that flight data in the FDPS correspond to actual flight plan data from the aircraft. This service should take place automatically at logon.
- It ensures common reference and prevents last minute tactical changes and coordination.
- Further steps will lead to full 4 D Intent checks.

DYNAV: DYNamic route Availability: Semi-Automated

- Automated assistance for the proposal of alternative routes to Aircrew as these become available (e.g. when military areas become free to civil use).
- Ground initiated, transparent to controllers;
- Aircrew can select among several alternative proposals and load the FMC.

PPD: Pilot Preferences Downlink

- Permits to downlink pilot preferences to the ground system for display to Controllers. These preferences relate to flight parameters having operational implications for ATC and not requiring Controller response.
- Top Of Descent, Preferred landing Runway, Min/Max operating speed range, Preferred cruising level, operating climb or descent speed, Min clean maneouvering speed, Min uncorrected approach speed, Preferred holding speed.

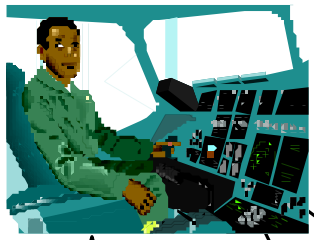
Data Link Flight Information Services (D-FIS)

- A data link system providing the ability for the pilot to receive D-FIS such as ATIS on the flight deck on request or automatically;
- Initial services concern the Automatic Terminal Information Service and METeorological Aerodrome Report;
- ODIAC has developed OTIS and Data link-Runway Visual Range delivery;
- Can be addressed or broadcast.

Cooperative ATS

- ***An element of ATM that enhances the productivity and safety of ATS by optimising the involvement of controllers, Aircrew and Airline operators through integrated data communications, improved forms of surveillance and automation.***

COOPERATIVE
AIR TRAFFIC SERVICES



Data Link
Flight Information Services

To provide the pilot with

Automatic Terminal Information (ATIS)
Runway Visual Range (RVR)
Meteo Information (SIGMET, SPECI, etc.)

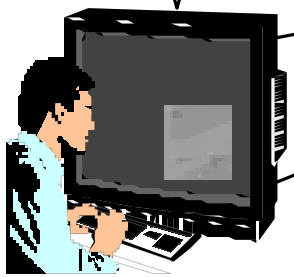
Shared Information and Common Reference

To achieve

Airborne traffic situation awareness
Cooperative separation assurance
Cooperative delegated separations
Full delegation, autonomy of flight

Controller/ Pilot
Data Link Communications

- Departure clearance
- Start up/ Push back/ Taxi clearances
- ATC En-Route and APP clearances
- Downstream clearances
- Communications automation
- 4D Trajectory coordination (FMS)



Downlink of Airborne Parameters

To provide the controller with

Elementary surveillance
(Position + Identification + Altitude)
Enhanced surveillance
(Heading + Speed + Short term intent)
Improved ATM through the use
of FMS 4D Flight path intent
Knowledge of Pilot Preferences

Delegated separations

- **For delegation of separations, the most complex and tricky issues lie with the considerable changes affecting the rules of the air, the pilots and controllers;**
- **Delegated separations IS NOT a surveillance concept or technique: It is a fundamentally new form of ATS requiring to change the rules of the air and ATS, all related standards, regulatory, safety, licensing and procedural issues;**
- **Even if technology is available today !**

Recommendations

- It is only when the lowest level of requirements specifications are done that we will start to know what we are talking about; Benefits must be reassessed continuously;
- It is only when real time ops trials are conducted that we will really know whether it is useful and safe;
- Certification and interoperability issues are extremely complex and costly;
- Do not assume or oversimplify OPS issues.
- Progress can only be step by step.

Together we have a lot of complex work ahead.

Aviation is an open transport system where in the end safety is the successful use of all elements in the system.

THANK YOU, QUESTIONS ?